

measurements obtained from transmissions between said mobile station MS and the communication stations;

wherein said first location estimator performs one or more of the following techniques (a) through (c) when supplied with said corresponding input data:

(a) an angulation technique for determining, for at least one of the communication stations, one of (i) and (ii) following: (i) a distance between the communication station and the mobile station MS, said distance dependent upon signal time delay derived information as at least part of said corresponding input data, and (ii) a wireless signal angle of arrival between the mobile station MS and the communication station;

(b) a learning technique, wherein said learning technique learns an association for associating (b1) and (b2) following:

(b1) information, in said corresponding data, obtained from at least one of signal strength and signal time delay measurements of wireless signal between the mobile station MS and the communication stations, and

(b2) data identifying a location for the mobile station MS,

wherein said association is learned by a training process using a plurality of data pairs, each said data pair including: first information identifying a known location of some mobile station, and second information from wireless signal measurements between said some mobile station and one or more of the communication stations when said some mobile station is at the known location;

(c) a stochastic technique, wherein said stochastic technique uses a statistical correlation for correlating (c1) and (c2) following:

(c1) information, in said corresponding data, obtained from at least one of signal strength and signal time delay measurements of wireless signal between the mobile station MS and the communication stations, and

(c2) data identifying a location for the mobile station MS,

wherein said correlation is used for determining a probability that the mobile station MS is within an area;

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first receiving, from said first location estimator, in response to first supplying said first location estimator with its said corresponding data for said at least one occurrence, first location related information having at least a first estimate for a location of the mobile station MS;

second receiving, from said second location estimator, in response to second supplying said second location estimator with its said corresponding data for said at least one occurrence, second location related information having at least a second estimate for the location of the mobile station MS;

wherein each of said first and second location estimates is generated independently of the other of said first and second location estimate;

determining a resulting location estimate of the mobile station MS that is dependent upon: (a) a first value obtained from said first location related information, and (b) a second value obtained from said second location related information.

86 (New) The method as claimed in Claim 85, further including:

first supplying said first location estimator with its said corresponding data for said at least one occurrence; and

second supplying said second location estimator with its said corresponding data for said at least one occurrence;

87. (New) The method as claimed in Claim 85, further including a step of receiving said wireless signal measurements during a wireless communication between said mobile station MS and said plurality of communication stations for contacting an emergency response center.

88. (New) The method as claimed in Claim 85, wherein said step of providing access includes transmitting, through a telecommunications network, said first location estimator from a source site to an activation site for performing said step of first generating.

89. (New) The method as claimed in Claim 88, wherein said step of transmitting includes sending an encoding of said first location estimator via the Internet.

90. (New) (New) The method as claimed in Claim 85, further including a step of retrieving at least one of (d) and (e) following:

(d) first historical location data having (i) and (ii) following:

(i) a first set of previous location estimates generated by said first location estimator using first data obtained from wireless signal measurements of transmissions between: (1) one or more of a plurality of mobile stations, at a first plurality of locations, and (2) said plurality of communication stations, wherein said first set is selected by determining that a distance related between at least one of said previous location estimates of said first set, and said first estimate of the location of the mobile station MS has a predetermined relationship, and

(ii) data identifying said locations of said first plurality of locations; and

(c) second historical location data having (i) and (ii) following:

(i) a second set of previous location estimates generated by said second location estimator using second data obtained from wireless signal measurements of transmissions between: (1) one or more mobile stations, at a second plurality of locations, and (2) said plurality of communication stations, wherein said second set is selected by determining that a distance between at least one of said location estimates of said second set, and said second estimate of the location of the mobile station MS is determined to be less than a second predetermined value, and

(ii) data identifying said locations of said second plurality of locations.

91. (New) The method as claimed in Claim 85, further including, for at least one location estimate of said first and second location estimates, a step of obtaining a likelihood value that the location of said mobile station MS is in said one location estimate, wherein said likelihood value is obtained using previous location estimates generated by the location estimator that generated said one location estimate.

92. (New) The method as claimed in Claim 85, wherein said step of providing access includes providing a third mobile station location estimator, wherein said third mobile station location estimator generates an estimate of where said mobile station is unlikely to be located.

93. (New) The method as claimed in Claim 85, wherein said wireless signal measurements are measurements of transmissions between said mobile station MS and said plurality of communication stations, wherein said transmissions occur within an interval of time that is less than a predetermined duration.

94. (New) The method as claimed in Claim 85, further including performing a first simulation for predicting a likelihood of said mobile station MS being at said first location estimate, wherein said simulation uses pairs of location representations, a first member of each pair including a location estimate obtained from said first location estimator of a different mobile station, and a second member of the pair including a representation of an independently determined location of the different mobile station.

95. (New) The method as claimed in Claim 85, wherein at least one of said first and second location estimators utilize one of the following:

- (a) a pattern recognition location technique for estimating a location of said mobile station MS by recognizing a pattern of characteristics of said corresponding input data obtained from multiple transmission paths of the wireless signal measurements;

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- (b) a mobile base station estimator for estimating a location of said mobile station MS from location information received from a mobile base station detecting wireless transmissions of said mobile station MS;
- (c) a coverage area location technique for estimating a location of said mobile station MS by determining a common area of wireless coverage areas for different sets of one or more of said communication stations;
- (d) a negative logic location technique for estimating where said mobile station MS is unlikely to be located; and
- (e) a technique for estimating a location of said mobile station MS using values from said corresponding input data obtained from timing signals received at the mobile station MS from one or more non-terrestrial communication stations.

96. (New) The method as claimed in Claim 85, wherein at least one of the following (a) through (c) holds:

- (a) for said learning technique, said association is provided, at least in part, by an artificial neural network for recognizing a pattern of characteristics of location information obtained from said wireless signal measurements;
- (b) said angulation technique provides the distances between the mobile station MS and said at least one communication station using one or more of: a wireless signal time of arrival, a wireless signal time difference of arrival, and a wireless signal strength indication; and
- (c) said stochastic technique provides said statistical correlation using one of: principle decomposition, least squares, partial least squares, and Bollenger Bands

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97. (New) A method for locating a mobile station using wireless signal measurements obtained from transmissions between said mobile station and a plurality of fixed location communication stations, wherein each of said communications stations includes one or more of a transmitter and a receiver for wirelessly communicating with said mobile station, comprising:

initiating one or more requests for information related to a location of said mobile station from one or more mobile station location evaluators such that when said location estimators are supplied with data having values obtained from wireless signal measurements obtained via transmissions between said mobile station and the communication stations, said one or more location evaluators perform at least two of the following techniques (i), (ii) and (iii) when said techniques are supplied with a corresponding portion of said data:

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- (i) a first technique for estimating a location of said mobile station using signal time delay values from a corresponding portion of said data obtained from signals received at the mobile station from one or more satellites, wherein said first technique uses said signal time delay values for determining one or more distances between said mobile station and said one or more satellites;
  - (ii) a second technique for recognizing a pattern of characteristics of a corresponding portion of said data, wherein said second technique uses an association for associating, for each of a plurality of mobile station locations, multipath wireless signal characteristics between: (a) one or more of the communication stations, and (b) a mobile station at the location; and
  - (iii) a third technique, wherein said third technique uses a statistical correlation for correlating (a) and (b) following:
    - (a) values of said corresponding portion of said data for the third technique, wherein said values are indicative of at least one of: a signal strength and a signal time delay of wireless signals between said mobile station and the communication stations, and

(b) information indicative of a location for said mobile station, wherein said correlation is used for determining a likelihood that the mobile station is within a corresponding geographic area;

first obtaining, from said one or more location estimators, a first one or more estimates using a supplied first one or more corresponding portions of said data for at least a first time when said first one or more corresponding portions are available;

transmitting, to a predetermined destination via a communications network, a resulting location estimate of said mobile station that is obtained from said first one or more location estimates.

98 (New) The method of Claim 97, further including the following steps:

second obtaining, from said one or more location evaluators, second one or more location estimates using a supplied second one or more corresponding portions of said data for at least one of: said first time and a second time when said second one or more corresponding portions are available;

determining said resulting location estimate of the mobile station, wherein said resulting location estimate is dependent upon: (a) a first value obtained from said first one or more location estimates, and (b) a second value obtained from said second one or more location estimates.

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99. (New) A method for locating a mobile station using wireless signal measurements obtained from transmissions between said mobile station and a plurality of fixed location communication stations, wherein each of said communications stations includes one or more of a transmitter and a receiver for wirelessly communicating with said mobile station, comprising:

initiating one or more requests for information related to a location of said mobile station from one or more mobile station location evaluators such that when said location estimators are supplied with data having values obtained from wireless signal measurements obtained via transmissions between said mobile station and the communication stations, said one or more location evaluators perform at least two of the following techniques (i), (ii) and (iii) when said techniques are supplied with a corresponding portion of said data:

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- (i) a first technique for estimating a location of said mobile station using signal time delay values from a corresponding portion of said data obtained from signals received at the mobile station from one or more satellites, wherein said first technique uses said signal time delay values for determining one or more distances between said mobile station and said one or more satellites;
  - (ii) a second technique for recognizing a pattern of characteristics of a corresponding portion of said data, wherein said second technique uses an association for associating, for each of a plurality of mobile station locations, multipath wireless signal characteristics between: (a) one or more of the communication stations, and (b) a mobile station at the location; and
  - (iii) a third technique for determining, for at least one of the communication stations, one of (a) and (b) following: (a) a distance between the communication station and the mobile station, said distance dependent upon measurements of a time delay of signals transmitted between the mobile station and at least one of the communication stations, said measurements obtained from a corresponding portion of said data, and (b) a wireless signal angle of arrival between the mobile station MS and the communication station;



first obtaining, from said one or more location estimators, a first one or more estimates using a supplied first one or more corresponding portions of said data for at least a first time when said first one or more corresponding portions are available;

transmitting, to a predetermined destination via a communications network, a resulting location estimate of said mobile station that is obtained from said first one or more location estimates.

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100. (New) A location system for locating a mobile station, wherein said mobile station is one of a plurality of mobile stations, and signal measurements are available of wireless transmissions between the plurality of mobile stations and a plurality of fixed location stations, the improvement characterized by:

one or more location estimators, each said location estimator for estimating a location for each of one or more individual mobile stations of the plurality of mobile stations, when said location estimator is supplied with data obtained from a set of said wireless signal measurements provided by wireless transmissions between the individual mobile station and at least one of said plurality of fixed location stations;

an archive for storing a plurality of data item collections, wherein for each geographical location of a plurality of geographical locations, there is one of said data item collections having (a1) and (a2) following:

(a1) a representation of the geographical location, and

(a2) data obtained from wireless signal measurements provided by one of the plurality of mobile stations transmitting from approximately the geographical location of (a1);

a performance evaluator for determining, for at least one of said location estimators, a corresponding one or more performance measurements indicative of a previous performance of said one location estimator in locating one or more of the plurality of mobile stations, wherein said corresponding performance measurements are determined using said data item collections;

a controller for activating a group of at least one of said location estimators for generating corresponding location estimates of said mobile station when a first said set of wireless signal measurements provided by wireless transmissions between said mobile station and said plurality of fixed location stations is obtained, wherein one or more location hypotheses are generated, each having (b1) and (b2) following:

(b1) a location estimate of said mobile station that is dependent upon one of the corresponding location estimates generated by one of the location estimators of said group, and

(b2) a corresponding likelihood value indicating a likelihood of said mobile station being at a location represented by said hypothesized location estimate of (b1), wherein said one or more corresponding performance measurements for said one location estimator providing the location estimate of (b1) are used in determining said corresponding likelihood value;

a location estimator for determining a resulting location estimate of said mobile station, said resulting location estimate being derived using at least one of said hypothesized location estimates and said corresponding likelihood values from said one or more location hypotheses.

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101. (New) A method for locating a mobile station, MS, wherein said mobile station MS is one of a plurality of mobile stations, and signal measurements are capable of being obtained from wireless transmissions between the plurality mobile stations and a plurality of fixed location communication stations, each capable of at least one of: wirelessly detecting said mobile station MS, and wirelessly being detected by said mobile station MS the improvement characterized by:

providing access to a mobile station location estimator for estimating, for each of one or more of said mobile stations, a location of the mobile station when said location estimator is supplied with corresponding input data obtained using said signal measurements obtained from wireless transmissions between the mobile station and said plurality of communication stations;

storing a plurality of data item collections, wherein for each of a plurality of geographical locations, there is one of said data item collections having (a1) and (a2) following:

(a1) a representation of the geographical location, and

(a2) a representation of said signal measurements between one of the mobile stations and the plurality of communication stations when said one mobile station is approximately at the geographical location of (a1);

first obtaining, from said signal measurements between said mobile station MS and said plurality of communication stations, an initial location estimate of said mobile station MS from said location estimator;

second obtaining one or more additional location estimates generated by said location estimator, wherein each said additional location estimate is generated from input supplied from at least one of said representations of signal measurements of (a2) for at least one of said data item collections, and wherein at least a majority of said additional location estimates satisfy a predetermined constraint dependent on said initial location estimate;

deriving a further location estimate of said mobile station MS using a group of one or more of said geographical location representations of (a1) for said data item collections

whose representations of signal measurements of (a2) were used to generate one of said additional location estimates.

102. (New) The method as ~~claimed~~ in Claim 101, wherein said step of deriving includes determining an area boundary of said further location estimate as a function of said geographical locations in said group.

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103. (New) A location system for locating a mobile station MS using wireless signal measurements obtained from transmissions between said mobile station MS and a network of fixed location transceivers, wherein said transceivers are cooperatively linked for use in locating the mobile stations, the improvement characterized by:

a communications interface for routing to each of one or more location estimators corresponding input data for estimating one or more initial locations of said mobile station MS, wherein said corresponding input data is obtained using measurements of wireless signals obtained from transmissions between:

- (i) the mobile station MS, at a corresponding geographical location, and
- (ii) the network of transceivers;

a location estimate adjuster for deriving an additional location estimate of said mobile station MS using a first initial location estimate generated by a first of said location estimators, wherein:

(a1) said additional location estimate has a corresponding confidence value indicative of a likelihood of the geographical location of the mobile station MS being a location represented by said additional location estimate, and

(a2) said additional location estimate is determined using other location estimates generated by said first location estimator previously to the generation of said first initial location estimate, wherein said other location estimates are within a predetermined area about said first initial location, and said additional location estimate is determined using known locations corresponding to said other location estimates; and

an output gateway for transmitting, to a predetermined destination, a resulting location estimate that is dependent upon one or more of said first initial location estimate and said additional location estimate.

104. (New) The location system, as claimed in Claim 103, wherein said location estimate adjuster includes a statistical simulation module for deriving one or more likelihood

values indicative of said first location estimator generating a location estimate that includes the geographical location of MS.

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105. (New) The location system, as claimed in Claim 103, further including a most likely estimator for determining said resulting location estimate of the corresponding geographical location of the mobile station MS, said most likely location estimate being derived using said additional location estimate and its corresponding confidence value, said most likely estimator includes a probability density function for fuzzifying at least said confidence value for said additional location estimate over an area adjacent a boundary of said additional location estimate.

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106. (New) A location system for locating mobile stations using wireless signal data obtained from transmissions between said mobile stations and a network of fixed location transceivers, wherein said transceivers in the network are cooperatively linked for use in locating said mobile stations, the improvement characterized by:

an archive for storing a plurality of data item collections, wherein for each of a plurality geographical locations, there is one of said data item collections having (a1) and (a2) following:

- (a1) a representation of the geographical location,
- (a2) a set of said wireless signal data obtained using transmissions between one of said mobile stations and the network, wherein the one mobile station transmits from approximately the geographical location of (a1);

a plurality of location estimators, one or more of which are trainable, wherein each said trainable location estimator for generating geographical location estimates for said mobile stations, wherein for each said trainable location estimator, there is a corresponding group of wireless signal measurement parameters, wherein for said location estimator to generate a location estimate of an individual one of said mobile stations, at least some of said parameters must be instantiated with values obtained from transmissions between said individual mobile station and the network, and wherein each said trainable location estimator learns by associating, for each of at least some of said data item collections, said geographical location representation (a1) of the data item collection with said set of said wireless signal measurements (a2) of the data item collection;

a location estimator selector for selecting one or more of said plurality of location estimators for generating mobile station location estimates;

wherein for locating a particular one of said mobile stations, said location estimator selector selects each of one or more of said location estimators according to whether at least one of said parameters from said corresponding group of parameters for the trainable location estimator is capable of being instantiated using wireless signal measurements obtained from transmissions between said particular mobile station and the network.



107. (New) The location system of Claim 106, further including a combiner location estimator for determining a resulting location estimate of said particular mobile station by combining a plurality of location estimates from the selected one or more location estimators.

108. (New) The location system, as claimed in Claim 106, wherein at least a first of said trainable location estimators includes a first artificial neural network.

109. (New) The location system as claimed in Claim 108, wherein said one or more trainable location estimators includes a second trainable location estimator that utilizes a second artificial neural network different from said first artificial neural network, for generating a geographical location estimate for locating one of said one mobile stations.

110. (New) The location system as claimed in Claim 108, wherein said first artificial neural network is one of: a multilayer perceptron, an adaptive resonance theory model, and radial basis function network.

111. (New) The location system as claimed in Claim 106, wherein for at least one said trainable location estimators, the trainable location estimator has, from its corresponding group of parameters, a parameter for receiving a value related to wireless transmissions between said particular mobile station and one of said fixed location transceivers, wherein said value is indicative of at least one of the following conditions:

- (a) said one transceiver is active for wireless communication with said particular mobile station and a pilot signal by said one transceiver is detected by said particular mobile station;
- (b) said one transceiver is active for wireless communication with said particular mobile station and said one transceiver detects wireless transmissions by said particular mobile station;

(c) said one transceiver is active for wireless communication with said particular mobile station and said one transceiver does not detect wireless transmissions by said particular mobile station;

(d) said one transceiver is active for wireless communication with said particular mobile station and said particular mobile station does not detect wireless transmissions by said one transceiver; and

(e) said one transceiver is not active for wireless communication with said particular mobile station.

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112. (New) A location system for receiving wireless signal measurements of wireless signals transmitted between a plurality mobile stations and a network of transceivers, wherein said transceivers in the network are cooperatively linked for use in locating the mobile stations, the improvement characterized by:

a mobile station location providing means for providing location estimates of said mobile stations, such that when said providing means is supplied with said measurements of wireless signals transmitted between a particular one of the mobile stations and said network, said providing means provides a first collection of one or more location estimates for said particular mobile station;

an expert system for activating expert system rules for one of: (a) modifying one of said location estimates of said first collection, and (b) obtaining additional location estimates of the particular mobile station;

a most likely estimator for determining a most likely location estimate of the particular mobile station, said most likely estimator uses one or more location estimates provided by said expert system for determining said most likely location estimate.

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113. (New) A location system for locating a wireless mobile station that is capable of communicating with a plurality of networked base stations, comprising:

a transceiver: (a) for at least detecting a direction of wireless signals transmitted from the mobile station, and (b) for communicating with said networked base stations information related to a location of said wireless mobile station;

a signal analyzer for determining whether a detected wireless signal from said mobile station has been one of: reflected and deflected;

one or more location estimators for providing one or more location estimates of said mobile station by using wireless signals transmitted from said mobile station, wherein at least one of said location estimators utilize the signals from said mobile station that are determined to be neither reflected nor deflected; and

transport means for moving at least said transceiver when locating said wireless mobile station.

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114. (New) The location system as claimed in Claim 113, wherein said signal analyzer includes a comparator for comparing: (a) a distance of said mobile station from said transceiver using a signal strength of said wireless signals from said mobile station, with (b) a distance of said mobile station from said transceiver using a signal time delay measurement of wireless signal from said mobile station.

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115. (New) The location system as claimed in Claim 113, further including one or more location estimators for estimating a location of said transceiver, wherein at least one of said transceiver location estimators uses measurements of wireless signals transmitted from one of: said networked base stations and a global positioning satellite system.

116. (New) The location system as claimed in Claim 115, further including a deadreckoning component operatively movable with movements of said transceiver for estimating a change in a location of said transceiver, wherein said deadreckoning component

determines incremental updates to at least one location estimate of said transceiver output by at least one of said transceiver location estimators.

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117. (New) A method for locating a wireless mobile station, MS, using measurements of wireless signals, wherein at least one of: said measurements and said wireless signals are transmitted between the mobile station MS and at least one of a plurality of transceivers, wherein said transceivers are capable of at least wireless detection of a plurality of wireless transmitting mobile stations, including said mobile station MS, comprising:

providing access to first and second mobile station location estimators, wherein each of said location estimators is capable of providing a location estimate for each mobile station of at least some of said mobile stations when said location estimator is supplied with corresponding data obtained from wireless signal measurements communicated between the mobile station and one or more of said plurality of transceivers, wherein:

- (a) said first location estimator performs one or more locating techniques, utilizing its said corresponding data, for determining a locus of locations for the mobile station MS from at least one of the transceivers, wherein said corresponding data is a function of a signal time delay between the mobile station MS and one or more of the transceivers, and
- (b) said second location estimator performs at least one of (b1) through (b3) following;

- (b1) an angle of arrival locating technique for estimating a location of the mobile station MS, wherein said angle of arrival locating technique determines a location estimate of the mobile station MS using a direction from which wireless signals arrive at at least one of the transceivers from the mobile station MS;
- (b2) a negative logic technique for estimating at least one area where the mobile station MS is unlikely to be located;
- (b3) a signal processing technique for estimating a location of the mobile station MS using wireless signals received by the mobile station MS from a plurality of non-terrestrial transmitting stations, wherein said wireless signals provide time values, and said signal processing technique determines at least

one differential between the time values for the wireless signals transmitted by two of the non-terrestrial transmitting stations;

first supplying said first location estimator with first corresponding data obtained from received wireless signal measurements communicated between said mobile station MS and one or more of said plurality of transceivers;

second supplying said second location estimator with second corresponding data obtained from received wireless signal measurements communicated between said mobile station MS and one or more of said plurality of transceivers;

first receiving from said first location estimator, first location related information having at least a first estimate for the mobile station MS's location;

second receiving from said second location estimator, second location related information having at least a second estimate for the mobile station MS's location;

determining a resulting location estimate of the mobile station MS using: (a) a first value obtained from said first location related information, and (b) a second value obtained from said second location related information.

118. (New) A method for locating a wireless mobile station, comprising:  
repeatedly performing the following steps (A1) through (A3) for tracking the mobile station;

(A1) receiving a location estimate of the mobile station from at least one of a first and a second mobile station location estimators, wherein each of said location estimators is capable of providing a location estimate for said mobile station, wherein:

(a) said first location estimator estimates a location of the mobile station when supplied with first data, wherein said first data includes timing values obtained from wireless timing signals received by the mobile station from one or more satellites; and

(b) said second location estimator estimates a location of the mobile station when supplied with second data, wherein said second location estimator uses values from said second data that are obtained from time delays of wireless signals transmitted between the mobile station and at least one transceiver of a plurality of transceivers cooperatively linked together for use in locating the mobile station;

wherein each of said first and second location estimators provides at least one location estimate of the mobile station at some time during said repeated performances of said receiving step;

(A2) determining resulting location information of said mobile station using at least one of: (a) a first value obtained from a first location estimate received from said first location estimator, and (b) a second value obtained from a second location estimate received from said second location estimator;

wherein said step of determining includes determining a likely location of the mobile station by determining a likely roadway upon which the mobile station is located;

(A3) providing said resulting location information for displaying on a display device, wherein said resulting location information is displayed as at least one location of the mobile station on a map having roadways thereon.



119. (New) A method for locating, from a plurality of wireless mobile stations, one of the wireless mobile stations using measurements of wireless signals, wherein at least one of: said measurements and said wireless signals are transmitted between said one mobile station and at least one of a plurality of fixed location stations, each station capable of at least one of receiving wireless signals from, and transmitting wireless signals to said one mobile station, comprising:

receiving, from each of at least first and second mobile station location estimators, corresponding first and second location estimates of said one mobile station, wherein for estimating a location,  $L_A$ , of some second one of the mobile stations at time  $T_A$ , said first location estimator is capable of generating a corresponding location without requiring a prior location estimate generated by said second location estimator for locating the second mobile station at the location  $L_A$  at substantially the time  $T_A$ , and, for estimating a location,  $L_B$ , of some third one of the mobile stations at time  $T_B$ , said second location estimator is capable of generating a corresponding location without requiring a prior location estimate generated by said first location estimator for locating the third mobile station at the location  $L_B$  at substantially the time  $T_B$ ;

wherein (A1) and (A2) following hold:

(A1) said first location estimator performs one or more coverage area analysis techniques when said first location estimator is supplied with first data obtained from wireless signal measurements communicated between said one mobile station and one or more of said plurality of fixed location stations, wherein each said coverage area analysis technique determines for said one mobile station, at least one of (i) and (ii) following: (i) an area determined using a corresponding area for each of one or more of said fixed location stations that wirelessly detect said one mobile station, or is wirelessly detected by said one mobile station, and (ii) an area excluded from a corresponding area for each of one or more of said fixed location stations that can not detect said one mobile station, or can not be detected by said one mobile station, and

(A2) said second location estimator, when supplied with second data obtained from wireless signal measurements communicated between said one mobile station and one or

more of said plurality of fixed location stations, performs at least one of the location techniques (i) through (v) following:

- (i) a pattern recognition technique, wherein said pattern recognition technique estimates a location of one of the particular mobile station from a pattern of a plurality of time delayed signal strengths of the wireless signal measurements provided by said second data;
- (ii) a trainable mobile station location estimating technique for estimating a location of said one mobile station, wherein said trainable mobile station location estimating technique is capable of being trained to associate (1) and (2) following: (1) each location of a plurality of geographical locations, and (2) corresponding measurements of wireless signals transmitted between some one of the mobile stations and the fixed location stations, wherein said some mobile station is approximately at the location;
- (iii) a locus computing technique for estimating a location of said one mobile station, wherein said locus computing technique utilizes measurements of wireless signals from said second data between said one mobile station and two or more of the fixed location stations for determining a locus of locations for said one mobile station, wherein said measurements are a function of a signal time delay between said one mobile station and at least one of the two or more fixed location stations;
- (iv) an angle of arrival technique for estimating a location said one mobile station, wherein said angle of arrival technique determines a location estimate of said one mobile station using a direction from which wireless signals arrive at at least one of the fixed location stations from said one mobile station;
- (v) a signal processing technique for estimating a location of said one mobile station using wireless signals received by said one mobile station from one or more non-terrestrial transmitting stations, wherein said wireless signals provide time values, and said signal processing technique determines

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at least one differential between the time values for the wireless signals transmitted by two of the non-terrestrial transmitting stations;  
determining a resulting location estimate of said one mobile station, wherein said step of determining includes at least one of the substeps (B1) through (B3) following:  
(B1) combining both of said first and second location estimates to obtain said resulting location estimate that is different from each of said first and second location estimates,  
(B2) obtaining one or more values rating said first and second location estimates, wherein said values are indicative of relative expected performances of said first and second location estimators in locating said one mobile station,  
(B3) selecting one of said first and second estimates for receiving preference in determining said resulting location.

120 (New) The method of Claim 119, wherein said one mobile station is part of a mobile base station.

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121. (New) A method for locating a wireless mobile station capable of wireless communication with a plurality of fixed location terrestrial stations, comprising:

providing access to a plurality of mobile station location estimators, wherein said location estimators provide location estimates of said mobile station when said location estimators are supplied with corresponding input information derived from wireless signal measurements transmitted from or received at the mobile station;

receiving, over time, a plurality of location estimates of the mobile station, wherein said step of receiving includes steps (a) and (b) following:

(a) first receiving, from a first of said location estimators, a first one or more location estimates of the mobile station, wherein said corresponding input information for said first location estimator includes timing data from wireless signals transmitted from one or more global positioning satellites, and received by the mobile station;

(b) second receiving, from a second of said location estimators, a second one or more location estimates of the mobile station, wherein said corresponding input information for said second location estimator includes data from wireless signals transmitted between the wireless mobile station and said plurality of fixed location terrestrial stations, and wherein said corresponding input information is a function of a signal time delay between the mobile station and at least one of the fixed location terrestrial stations;

determining, a plurality of consecutive resulting location estimates for tracking the mobile station, wherein said step of determining includes deriving at least one of said resulting location estimates of the mobile station using a location estimate most recently generated from one of said first one or more location estimates by said first location estimator, and deriving at least one of said resulting location estimates of the mobile station using a most recently generated one of said second one or more location estimates by said second location estimator.

122. (New) The method as claimed in Claim 121, wherein said step of determining includes:

establishing a priority between location estimates of said first location estimator and said location estimates of said second location estimator.

123. (New) The method as claimed in Claim 122, wherein said step of establishing includes obtaining a confidence value for one or more of: (a) at least one of said location estimates for said first one or more location estimates; and (b) at least one of said location estimates for said second one or more location estimates;

wherein each said confidence value is indicative of a likelihood of the mobile station having a location represented by said corresponding location estimate for the confidence value.

124. (New) The method as claimed in Claim 121, wherein said step of determining includes preferring a location estimate of said first one or more location estimates over a location estimate of said second one or more location estimates when both are available for substantially a same location of the mobile station.

125. (New) The method as claimed in Claim 121, wherein said step of determining includes, for at least one of said resulting location estimates, determining one or more of: (a) a velocity of the mobile station, (b) an acceleration of the mobile station, and (c) one or more features of an area near said resulting location estimate.

126. (New) A method for providing a location estimate of a wireless mobile station using measurements of wireless signals, comprising:

first transmitting, when available, a first collection of measurements of wireless signals transmitted between said mobile station and one or more satellites, to a first location estimator;

second transmitting, to a second location estimator, a second collection of measurements obtained from wireless signals transmitted between said mobile station and one or more fixed location terrestrial stations, at least when said first collection is not available, wherein said second collection includes signal time delay data of wireless signals transmitted between the mobile station and the fixed location terrestrial stations;

wherein said second location estimator determines a location estimate of the mobile station dependent upon the mobile station being approximately on a locus of locations from at least one of the fixed location terrestrial stations, said locus including substantially only locations where a signal time delay dependent condition is satisfied;

first obtaining a first location estimate of said mobile station when said first location estimator is supplied with an instance of said first collection;

second obtaining a second location estimate of said mobile station when said second location estimator is supplied with an instance of said second collection;

outputting a resulting location estimate that is dependent upon at least one of said first and second location estimates.

127. (New) The method as claimed in Claim 126, further including receiving a signal from the mobile station for assistance.

128. (New) The method of Claim 126, wherein said step of outputting includes one of more of:

- (a) sending said resulting location through the Internet to a known destination;
- (b) prioritizing said first and second location estimates when both are available for locating the mobile station at substantially a same time;

- (c) combining said first and second location estimates when both are available for locating the mobile station at substantially a same time; and
- (d) sending said resulting location to an emergency response center.

129. (New) The method of Claim 126, wherein said condition includes one of a triangulation and a trilateration using one of a time of arrival and a time difference of arrival of wireless signals transmitted between the mobile station and the at least one fixed location terrestrial station.

130. (New) The method of Claim 126, wherein at least one of said steps of first and second transmitting includes one of said first and second collections on at least a portion of the Internet.

131. (New) A method for locating a mobile station using wireless signal measurements obtained from transmissions between said mobile station and a plurality of fixed location communication stations, wherein each of said communications stations includes one or more of a transmitter and a receiver for wirelessly communicating with said mobile station, comprising:

providing access to first and second mobile station location evaluators, wherein said location evaluators determine information related to one or more location estimates of said mobile station when said location estimators are supplied with data having values obtained from wireless signal measurements obtained via transmissions between said mobile station and the communication stations, wherein (A) and (B) following:

(A) said first location evaluator performs one or more of the following techniques (i), (ii) and (iii) when supplied with corresponding instances of said data:

(i) a first technique for determining, for at least one of the communication stations, one of: a wireless signal angle of arrival, and a time difference of arrival between the mobile station and the at least one communication station;

(ii) a second technique for estimating a location of said mobile station, using values from a corresponding instance of said data obtained from signals received at the mobile station from one or more satellites;

(iii) a third technique for recognizing a pattern of characteristics of a corresponding instance of said data, wherein said pattern of characteristics is indicative of a plurality of wireless signal transmission paths between the mobile station and each of one or more of the communication stations; and

(B) for the one or more of said techniques performed by said first location estimator, said second location evaluator performs a different combination of said one or more of said techniques when supplied with corresponding instances of said data for the one or more techniques of said different combination;

first obtaining, from said first location estimator, first location related information for identifying a location of the mobile station for at least one of the following situations: a



tracking of the mobile station, and in response to a request for a location of the mobile station, wherein said first location estimator uses one or more available first corresponding instances of said data for said one or more techniques performed by said first location estimator;

second obtaining, from said second location evaluator, second location related information for identifying a location of the mobile station for said same at least one situation, wherein said second location estimator uses one or more available second corresponding instances of said data for said different combination;

determining a resulting location estimate of the mobile station dependent upon at least one of: (a) a first value obtained from said first location related information, and (b) a second value obtained from said second location related information.

132. (New) The method as claimed in Claim 131, wherein said mobile station is co-located with a processor for activating at least one of said location estimators.

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133. (New) A method for locating a mobile station when there is an occurrence of at least one of: said mobile station being tracked, and a request for locating said mobile station, wherein said method uses wireless signal measurements obtained from transmissions between said mobile station and a plurality of fixed location communication stations, wherein each of said communications stations includes one or more of a transmitter and a receiver for wirelessly communicating with said mobile station, comprising:

providing access to first and second mobile station location evaluators, wherein said location evaluators determine information related to one or more location estimates of said mobile station when said location estimators are supplied with data having values obtained using wireless signals obtained via transmissions between said mobile station and the communication stations, wherein (A) and (B) following:

(A) said first location evaluator performs one or more of the following techniques (i), (ii) and (iii) when supplied with corresponding instances of said data:

(i) a first technique to determine a wireless signal angle of arrival between the mobile station and at least one of the communication stations;

(ii) a second technique for estimating a location of said mobile station using values from a corresponding instance of said data obtained from timing signals received at the mobile station from one or more satellites;

(iii) a third technique, wherein said third technique uses a statistical correlation for correlating (a) and (b) following:

(a) wireless signal related values of a corresponding instance of said data instance; and

(b) information indicative of a location for the mobile station, wherein said correlation is used for determining a probability that the mobile station is within at least one geographical area, and

(B) for said one or more of said techniques performed by said first location estimator, said second location estimator performs a different combination of said one or more of said techniques when supplied with corresponding instances of data for the one or more techniques of said different combination;

first generating, by said first location estimator, first location related information of the mobile station's location, for said at least one occurrence, using available first corresponding instances of said data of said one or more said techniques performed by said first location estimator;

second generating, by said second location estimator, second location related information of the mobile station's location, for said at least one occurrence, using available second corresponding instances of said data for said different combination;

wherein each of said first and second location related information is capable of being generated independently of the other of said first and second location related information;

determining a resulting location estimate of the mobile station using at least one of: (a) a first value obtained from said first location related information, and (b) a second value obtained from said second location related information;

wherein said step of determining includes a step of identifying one or more subareas for said resulting location, said one or more subareas selected from a predetermined plurality of subareas of a larger mapped area.

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134. (New) A method for locating a mobile station using wireless signal measurements obtained from transmissions between said mobile station and a plurality of fixed location communication stations, wherein each of said communications stations includes one or more of a transmitter and a receiver for wirelessly communicating with said mobile station, comprising:

receiving a request for a location of the mobile station;

generating one or more requests for information related to a location of said mobile station from one or more mobile station location evaluators such that when said location estimators are supplied with data having values obtained from wireless signal measurements obtained via transmissions between said mobile station and the communication stations, said one or more location evaluators perform at least two of the following techniques (i), (ii), (iii) and (iv) when said techniques are supplied with a corresponding portion of said data:

- (i) a first technique for determining at least one location area or locus for said mobile station using one of: a time of arrival of wireless signals, and a time difference of arrival of wireless signals between the mobile station and at least one communication station;
- (ii) a second technique for determining, for at least some one of the communication stations, a wireless signal angle of arrival between the mobile station and the at least some one communication station;
- (iii) a third technique for estimating a location of said mobile station, using timing values from a corresponding portion of said data obtained from signals received at the mobile station from one or more satellites;
- (iv) a fourth technique, wherein said fourth technique provides a pattern recognizer for estimating a location of said mobile station by deriving said location estimate from a pattern of multipath wireless signal characteristics between: (a) one or more of the communication stations, and (b) said mobile station;

first obtaining, from said one or more location estimators, a first one or more location estimates using an available first one or more corresponding portions of said data;

determining a resulting location estimate of the mobile station obtained from at least one of said first one or more location estimates;

wherein at least one of said steps of receiving, generating, first obtaining, and determining include a substep of one of: (i) transmitting information to a predetermined destination using one of a public switched network and the Internet, and (ii) receiving information from a predetermined source using one of a public switched network and the Internet.

135. (New) The method of Claim 134, further including a step of outputting said resulting location estimate to a location identified by said request.

136. (New) The method of Claim 134, further including requesting that the mobile station raise its wireless signal transmission power prior to the wireless signal measurements being obtained via transmissions between said mobile station and the communication stations.

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137. (New) A method for locating a mobile station when there is an occurrence of at least one of: said mobile station being tracked, and a request for locating said mobile station, wherein said method uses wireless signal measurements obtained from transmissions between said mobile station and a plurality of fixed location communication stations, wherein each of said communications stations includes one or more of a transmitter and a receiver for wirelessly communicating with said mobile station, comprising:

providing first and second mobile station location evaluators, wherein said location evaluators determine information related to one or more location estimates of said mobile station when said location estimators are supplied with data having values obtained from wireless signal measurements obtained via transmissions between said mobile station and the communication stations, wherein (A) and (B) following:

(A) said first location evaluator performs one or more of the following techniques (i), (ii), (iii) and (iv) when said techniques are supplied with a corresponding instance of said data:

(i) a first technique for determining, for at least one of the communication stations, one of: a wireless signal angle of arrival, and a time difference of arrival between the mobile station and the at least one communication station;

(ii) a second technique for estimating a location of said mobile station, using timing values from a corresponding instance of said data obtained from signals received at the mobile station from one or more satellites;

(iii) a third technique, wherein said third technique provides an association for associating, for each of a plurality of mobile station locations, multipath wireless signal characteristics between: (a) one or more of the communication stations, and (b) a mobile station at the location; and

(iv) a fourth technique, wherein said fourth technique uses a statistical correlation for correlating (a) and (b) following:

(a) wireless signal related values obtained from a corresponding instance of said data, and

(b) information indicative of a location for the mobile station, wherein said correlation is used for determining a value indicative of a likelihood that the mobile station is within a corresponding geographical area, and

(B) for said one or more of said techniques performed by said first location estimator, said second location evaluator performs a different combination of said one or more of said techniques when supplied with corresponding instances of said data for the one or more techniques of said different combination;

first obtaining, from said first location estimator, first location related information, for said at least one occurrence, using a supplied first one or more corresponding instances of said data for at least a time when said first one or more corresponding instances are available;

second obtaining, from said second location evaluator, second location related information, for said at least one occurrence, using a supplied second one or more corresponding instances of said data for at least a time when said second one or more corresponding instances are available;

wherein each of said first and second location related information is capable of being obtained substantially independently from the obtaining of the other of said first and second location related information;

determining a resulting location estimate of the mobile station dependent upon at least one of: (a) a first value obtained from said first location related information, and (b) a second value obtained from said second location related information.

138. (New) The method of Claim 137, wherein one or more of:

(a) said first technique includes a step of performing one of a triangulation and a trilateration;

(b) said third technique includes a step of activating an artificial neural network;

(c) a procedure said fourth technique includes performing one of: a principle decomposition , a least squares, a partial least squares, and a procedure using Bollenger Bands.

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139. (New) A method for locating a wireless mobile station using wireless signal measurements obtained from transmissions between said mobile station and a plurality of communication stations capable of wirelessly detecting said mobile station, comprising:

first determining whether a first location estimate of said mobile station is capable of being determined using a first combination of one or more of (a) through (c) following:

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- (a) a first technique for determining, for at least one of the communication stations, a wireless signal angle of arrival, and a time difference of arrival between the mobile station and the communication station using the wireless signal measurements;
  - (b) a second technique using measurements from signals received at the mobile station from one or more satellites;
  - (c) a pattern recognition location technique for estimating a location of said mobile station by recognizing a pattern of characteristics of data obtained from wireless signal measurements, wherein said pattern of characteristics is indicative of multipath wireless signal transmissions paths between the mobile station and one or more of the communication stations;
  - (d) an angle of arrival technique, wherein an angle of arrival of signal transmissions from said mobile station is determined at one or more of the communication stations;

second determining a second location estimate of said mobile station by a different combination of one or more of said techniques when one of: (i) said step of first determining determines that said first combination is unable to provide said first location estimate, and (ii) said second location estimate is expected to be more accurate or reliable than said first location estimate.

140. (New) A method for locating a mobile station using wireless signal measurements obtained from transmissions between said mobile station and at least one of a plurality of terrestrial communication stations capable of wirelessly detecting said mobile station, comprising:

providing access to one or more of the location techniques (a) through (c) following:

(a) a first technique for triangulating, wherein for each of three or more of the communication stations, one of: a signal time of arrival, and a signal time difference of arrival between the mobile station and the communication station is determined using a first input obtained from the wireless signal measurements;

(b) a second technique using a second input obtained from one or more transmissions between the mobile station and the communication stations, said second input including time delay measurements of signals received at the mobile station from one or more satellites;

(c) a third technique that learns an association between a plurality of pairs of (i) and (ii) following:

(i) characteristics of wireless signals communicated between some mobile station and one or more of the communication stations, and

(ii) a location of said some mobile station during the communication,

wherein said association is determined by a training process using a plurality of said pairs, wherein when said third technique is supplied with a third input of characteristics of wireless signals communicated between said mobile station and one or more of the communication stations, data indicative of a location of the mobile station is obtained;

determining whether a particular one of the location techniques (a) through (c) has its corresponding input available for determining a first location estimate of said mobile station;

determining a second location estimate of said mobile station by activating one of said location techniques different from said particular location technique when the corresponding input for said different technique is available.

141. (New) The method as claimed in Claim 140, wherein at least two of said location techniques generate location estimates of said mobile station that do not depend upon one another for their corresponding input to be available.

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142. (New) A method for locating a mobile station using wireless signal measurements obtained from transmissions between the mobile station and at least one of a plurality of communication stations, wherein each of said communications stations includes one or more of a transmitter and a receiver for wirelessly communicating with the mobile station wirelessly, comprising:

providing access to at least first and second location estimators for estimating a location of the mobile station, wherein for said first location estimator to estimate a location of the mobile station, said first estimator is dependent upon a result from a first location technique included in one of the following (a) through (e) location technique categories, and for said second location estimator to estimate a location of the mobile station, said second estimator is dependent upon a result from a second component included in a different one of the following (a) through (e) location technique categories:

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- (a) one of a trilateration and a triangulation technique for determining, for each of three or more of the communication stations, one of: a wireless signal time of arrival, and a wireless signal time difference of arrival between the mobile station and the communication station using a first input obtained from the wireless signal measurements;
  - (b) a stochastic technique, wherein said stochastic technique uses a statistical correlation for correlating (i) and (ii) following:
    - (i) a second input obtained from the wireless signal measurements, and
    - (ii) data indicative of a location area for the mobile station, wherein a probability that the mobile station is within the correlated location area is determined from said correlation;
  - (c) a learning technique, for learning an association, wherein said association is determined by a training process using a plurality of data pairs, each said pair including: first information indicative of a location of some mobile station, and second information from wireless signal measurements

between said some mobile station and one or more of the communication stations when said some mobile station is at the location, wherein when said learning technique is supplied with a third input obtained from the wireless signal measurements obtained from transmissions between the mobile station and at least one of a plurality of communication stations, data indicative of a location for the mobile station is determined;

(d) a pattern recognition location technique for estimating a location of the mobile station by recognizing a pattern of characteristics of a fourth input obtained from the wireless signal measurements, wherein said pattern of characteristics is indicative of multipath wireless signal transmissions between the mobile station and one or more of the communication stations;

(e) a location technique using a fifth input obtained from measurements from signals received at the mobile station from one or more satellites;

determining whether said first location estimator has its corresponding input available for determining a first location estimate of the mobile station;

determining a second location estimate of said mobile station by activating said second location estimator when the corresponding input for said second location estimator is available, and said corresponding input to said first location estimator is unavailable.

143. (New) The method as claimed in Claim 142, wherein

said first, second, third, and fourth inputs include data related to one or more of: a wireless signal time delay, a wireless signal strength, and a power level of the mobile station; and

said fifth input includes data related to GPS satellite signals.

144. (New) A method for locating one or more wireless mobile stations using wireless signal measurements obtained from transmissions between said mobile stations and a plurality of communication stations capable of at least one of: wirelessly detecting said mobile stations, and being wirelessly detected by said mobile stations, comprising:

archiving a plurality of data item collections, wherein each said data item collection includes (a1) and (a2):

(a1) a representation of a location of one of said mobile stations,

(a2) a set of measurements of said wireless signal data obtained from transmissions between one of said mobile stations and at least one of said communication stations, wherein said one mobile station transmits from approximately the corresponding location represented in (a1), and wherein said set of measurements include one or more of (i) and (ii) following:

(i) a signal strength measurement corresponding to a transmission between said one mobile station and one of said communication stations;

(ii) a signal time delay measurement corresponding to a transmission between said one mobile station and one of said communication stations;

providing a plurality of pattern matching location estimators, wherein at least one of said location estimators uses at least one association between (a1) and (a2) of the archived data item collections when locating one of said mobile stations;

receiving wireless signal data obtained from transmissions between said communication stations and a particular one of said mobile stations at an unknown location, wherein said wireless signal data includes one or more measurements for said set of measurements;

selecting, using a value dependent upon said wireless signal data, one or more of said location estimators;

determining one or more location estimates of said particular mobile station when said selected location estimators are provided with input obtained using said wireless signal data.

145. (New) The method as claimed in Claim 144, wherein, said step of selecting includes using a value indicative of an identification of at least one of said communication stations.

146. (New) The method as claimed in Claim 144, wherein said wireless signal data includes information indicative of one of: said particular mobile station being detected by at least one of said communication stations, and said particular mobile station detecting at least one of said communication stations.

147. (New) The method as claimed in Claim 144, wherein said set of measurements further includes one or more of:

- a value indicative of a make of said particular mobile station; and
- a value indicative of a model of said particular mobile station.

148. (New) The method as claimed in Claim 144, wherein said set of measurements further includes one or more of (a) through (f) following:

(a) a measurement indicative of a current transmission power of said particular mobile station;

(b) a measurement indicative of a maximum transmission power of said particular mobile station;

(c) a measurement indicative of a transmission power level of one of said communication stations;

(d) one or more values indicative of which of said communication stations is on-line and thereby capable of wireless communication with said particular mobile station;

(e) one or more values indicative of which of said communication stations detects a wireless transmission from said particular mobile station; and

(f) one or more values indicative of which of said communication stations is detected by said particular mobile station.

149. (New) The method as claimed in Claim 144, wherein one or more of said pattern matching location estimators includes one of: an artificial neural network, a genetic algorithm, a statistically based pattern recognition system, and an expert system.

150. (New) The method as claimed in Claim 149, wherein said statistically based pattern recognition system includes a regression analysis procedure.

151. (New) The method as claimed in Claim 144, wherein said step of selecting includes evaluating an expert system rule.

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152. (New) A location system for locating one or more wireless mobile stations using wireless signal measurements obtained from transmissions between said mobile stations and a plurality of communication stations capable of at least one of: wirelessly detecting said mobile stations, and being wirelessly detected by said mobile stations, comprising:

an archive for storing a plurality of data item collections, wherein each said data item collection includes (a1) and (a2) following:

- (a1) a representation of a location of one of said mobile stations,
- (a2) data indicative of said wireless signal transmissions between said one mobile station and at least one of said communication stations, wherein said one mobile station transmits from approximately the mobile station location;

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a plurality of location estimators, each of at least some of said location estimators accesses information indicative of at least one association between (a1) and (a2) for a plurality of said data item collections for determining a location estimate of an unknown location of a particular one of said mobile stations, wherein said location estimator uses a corresponding data set indicative of wireless signal transmissions between said particular mobile station at said unknown location, and one or more of said communication stations;

a location estimator selector for selecting one or more of said plurality of location estimators for determining one or more location estimates of said particular mobile station, said selector selects each said location estimator by using information indicative of identifications of one or more communication devices, wherein each said communication device: (i) is one of a wireless signal transmitter and a wireless signal receiver located at one of said communication stations, and (ii) communicates with said particular mobile station thereby providing at least a portion of said corresponding data set used by said location estimator.

153. (New) The location system as claimed in Claim 152, wherein, when said selector selects one of said location estimators that activates an artificial neural network.

154. (New) The location system as claimed in Claim 152, wherein at least one of said communication stations is included in a satellite.

155. (New) The location system as claimed in Claim 152, wherein one of said location estimators includes one of (a) and (b) following:

(a) a pattern recognition capability for estimating a location of said particular mobile station; and

(b) a statistical correlation technique for estimating a location of said particular mobile station;

wherein said one location estimator uses a derived relationship between said sets of wireless signal measurements of said archived data item collections for predicting a location of said particular mobile station.

156. (New) The location system as claimed in Claim 155, wherein one of: said statistical correlation technique uses one of: principle decomposition, least squares, partial least squares, and Bollenger Bands; and said pattern recognition capability uses an artificial neural network.

157. (New) The location system as claimed in Claim 156, wherein said artificial neural network includes one of: a multilayer perceptron, an adaptive resonance theory model, and a radial basis function network.

158. (New) The location system as claimed in Claim 152, wherein for selecting at least one of said location estimators, said identifications identify a predetermined plurality of wireless terrestrial fixed location wireless communication devices, and said corresponding data set for the location estimator includes information indicative of one or more of (a) through (c) following:

(a) whether one of said communication devices is on-line,

(b) whether one of said communication devices detects a wireless transmission from said particular mobile station, and

(c) whether said particular mobile station detects transmissions from one of said communication devices.

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159. (New) A method for locating a mobile station using wireless signal data obtained from transmissions between said mobile station and a plurality of communication stations capable of at least one of: wirelessly detecting said mobile station, and wirelessly being detected by said mobile station, comprising:

receiving said wireless signal data obtained from transmissions between said communication stations and said mobile station at an unknown location, wherein said wireless signal data includes at least two of (A1) through (A3) following:

(A1) signal timing measurements of wireless signal transmissions between said mobile station and one or more of said communication stations at terrestrial locations;

(A2) time delay measurements from wireless signal transmissions from one or more satellites to said mobile station, each of the satellites having one of the communication stations;

(A3) signal pattern characteristics of wireless signal transmissions between said mobile station and one or more of said communication stations, wherein said signal pattern characteristics are indicative of a multipath signal pattern at the unknown location between the mobile station and at least one of the communication stations;

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generating one or more location estimates of said mobile station, using said wireless signal data, and at least two of the following location techniques (B1) through (B4) following:

(B1) a triangulation or trilateration technique using the measurements from (A1);

(B2) a triangulation technique using the measurements from (A2);

(B3) a pattern recognition technique for estimating a location of said mobile station by recognizing a signal pattern of characteristics from (A3).

160. (New) The method as claimed in Claim 159, wherein said step of generating includes performing a stochastic technique for generating a location estimate of said mobile station, wherein said stochastic technique uses a statistical correlation for correlating:

- (i) measurements from said wireless signal data, and
- (ii) previously obtained wireless signal data indicative of a plurality of known mobile station locations;

wherein said stochastic technique determines a probability that said unknown location is within a geographic area associated with the probability.

161. (New) The method as claimed in Claim 159, wherein said step of generating includes providing at least one of said signal pattern measurements to a pattern recognizer that is trainable when repeatedly provided with previously obtained wireless signal data indicative of a plurality of known mobile station locations.

162. (New) The method as claimed in Claim 161, wherein said pattern recognizer includes one of: an artificial neural network and a genetic algorithm.

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163. (New) A mobile station location system, comprising:  
an interface to one or more mobile station location estimators for estimating locations of mobile stations, such that for each of at least some of the mobile stations, when said one or more location estimators are each supplied with corresponding data obtained from measurements of wireless signals transmitted between the mobile station, and at least one of:

(1) a plurality of communication stations capable of at least one of:  
wirelessly detecting said mobile stations, and being wirelessly detected  
by said mobile stations, and

(2) one or more non-terrestrial wireless signal transmitting stations,  
then said one or more location estimators each output corresponding location estimates of a geographical location of the mobile station;

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wherein for a first of said mobile station location estimators, when estimating a location of one of the mobile stations, said first estimator is dependent upon a result from a first component included in one of the following (a) through (f) component categories, and for a second of said mobile station location estimators, when estimating a location of one of the mobile stations, said second estimator is dependent upon a result from a second component included in a different one of the following (a) through (f) component categories:

(a) a category of pattern recognition components, wherein each said pattern recognition component estimates a location of one of the mobile stations from a pattern of a plurality of time delayed signal strengths of the wireless signal measurements provided by said corresponding data for said pattern recognition component;

(b) a category of trainable mobile station location estimating components for estimating a location of the mobile station, wherein each said trainable mobile station location estimating component is capable of being trained to associate: (i) each location of a plurality of geographical locations with (ii) corresponding measurements of wireless signals transmitted between some

one of said mobile stations and the plurality of communication stations, wherein said some mobile station is approximately at the location;

(c) a category of locus computing components for estimating a location of the mobile station, wherein said locus computing components utilize measurements of wireless signals from their said corresponding data between the mobile station and two or more of the communication stations for determining a locus of locations for the mobile station, wherein said measurements are a function of a signal time delay between the mobile station and at least one of the two or more communication stations, said at least one of the two or more communication stations being attached to the ground;

(d) a category of angle of arrival components for estimating a location of the mobile station, wherein each of said angle of arrival components determine a location estimate of the mobile station using a direction from which wireless signals arrive at at least one of the communication stations from the mobile station;

(e) a category of negative logic components for estimating an area of where the mobile station is unlikely to be located;

(f) a category of signal processing components for estimating a location of the mobile station using wireless signals received at the mobile station from the non-terrestrial transmitting stations, wherein said wireless signals provide time values, and said signal processing components determine at least one differential between the time values for the wireless signals transmitted by two of the non-terrestrial transmitting stations;

wherein said interface includes a component for communicating on a communications network with at least one of said one or more location estimators and thereby receiving, from said at least one estimator, said corresponding location estimate of the mobile station; and

a resulting estimator for determining a likely location estimate of a particular mobile station, said resulting estimator receiving one or more of said corresponding location estimates for the particular mobile station from said interface, said resulting estimator having at least one of: (i) a selector for identifying at least one preferred location estimate from said corresponding location estimates, said likely location estimate being at least as dependent on said preferred location estimate as any other of said one or more corresponding location estimates, and (ii) a combiner for combining said one or more corresponding location estimates for obtaining said likely location estimate.

164. (New) The location system, as claimed in Claim 163, wherein one or more of said mobile station location estimators are capable of being at least one of: added, replaced and deleted by transmissions on a communication network between a portion of said location system and a site remote from said portion.

165. (New) The location system as claimed in Claim 163, wherein one or more of:

- (a) at least one of said one or more corresponding location estimates has a corresponding value therewith indicative of a likelihood that the particular mobile station resides in a geographical area represented by said at least one corresponding location estimate, and said combiner uses said corresponding value for obtaining said likely location estimate; and
- (b) said component for communicating on the communications network includes a wireless transceiver for communicating with the plurality of communication stations;
- (c) said plurality of communication stations include base stations for wireless communication with said mobile stations;
- (d) said non-terrestrial wireless signal transmitting stations include GPS satellites;
- (e) said pattern recognition components includes an expert system generated by a statistically-based pattern recognition technique, and an artificial neural network;



(f) said trainable mobile station location estimating components includes an artificial neural network.

166. (New) The location system as claimed in Claim 163, wherein the plurality of communication stations provide communications for a portion of the Internet, and said interface uses a TCP/IP protocol for receiving said corresponding location estimate from said at least one estimator.

167. (New) The location system as claimed in Claim 163, further including an output gateway for receiving said likely location estimate and determining one or more of a plurality of location receiving applications for transmitting an output, obtained from said likely location, on one or more communications networks to said one or more location receiving applications.

168. (New) The location system as claimed in Claim 167, wherein said one or more location receiving applications includes applications for one of: 911 emergency, parolee surveillance, vehicle location, locating related persons, locating animals, providing a person having said particular mobile station with information indicative of his/her location.

169. (New) A mobile station location system, comprising:

an interface to a plurality of mobile station location estimators for estimating locations of mobile stations, such that for each of at least some of the mobile stations, when one or more of said location estimators are supplied with corresponding data obtained from measurements of wireless signals transmitted between:

- (i) the mobile station, and
- (ii) at least one of: a network of communication stations cooperatively linked for use in locating the mobile stations, and one or more non-terrestrial wireless signal transmitting stations,

then said one or more location estimators each output corresponding location estimates of a geographical location of the mobile station;

wherein for a first of said mobile station location estimators, when estimating a location of one of the mobile stations, said first estimator is dependent upon a result from a first component included in one of the following (a) through (c) component categories, and for a second of said mobile station location estimators, when estimating a location of one of the mobile stations, said second estimator is dependent upon a result from a second component included in a different one of the following (a) through (c) component categories:

- (a) a category of pattern recognition components for estimating a location of the mobile station from a pattern of a plurality of time delayed signal strengths of the wireless signal measurements provided by said corresponding data;
- (b) a category of triangulation components for estimating a location of the mobile station, wherein said triangulation components utilize measurements of wireless signals from their said corresponding data between the mobile station and three of the communication stations for determining a location estimate of the mobile station, wherein said measurements are a function of a signal time delay between the mobile station and at least one of the three communication stations, said at least one of the three communication stations being attached to the ground;
- (c) a category of signal processing components for estimating a location of the mobile station using wireless signals received at the mobile station from the non-

terrestrial transmitting stations, wherein said wireless signals provide time values, and said signal processing components determine at least one differential between the time values for the wireless signals transmitted by two of the non-terrestrial transmitting stations;

wherein said interface includes a component for communicating on a predetermined communications network for communicating with at least one of said first and second estimators and thereby receiving, from said at least one estimator, said corresponding location estimate of the mobile station; and

a resulting estimator for determining a likely location estimate of a particular mobile station, said resulting estimator receives one or more of said corresponding location estimates for the particular mobile station from said interface, said resulting estimator having at least one of: (i) a selector for selecting at least one preferred location estimate from said corresponding location estimates, said likely location estimate being at least as dependent on said preferred location estimate as any other of said corresponding location estimates, and (ii) a combiner for combining said corresponding location estimates for obtaining said likely location estimate.

170. (New) The mobile station location system of Claim 169, wherein said network communications are transmitted by at least one of: wirelessly, via a portion of the Internet, and the network of communication stations.

171. (New) The mobile station location system of Claim 169, further including a data identifier for determining, for at least one of said mobile station location estimators, whether its said corresponding data is available so that said at least one mobile station estimator is able to generate its said corresponding location estimate.

172. (New) The mobile station location system of Claim 169, further including at least one data base having information for determining, for at least one of said mobile station location estimators providing one of said corresponding location estimates for

locating the particular mobile station, a measurement of a likelihood of the particular mobile station being in geographical location represented by said one corresponding location estimate.

173. (New) The mobile station location system of Claim 169, further including a controller for receiving information indicative of a type of wireless signal measurements for locating the particular mobile station, and subsequently using said information for requesting activation of one of said mobile station location estimators.

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174. (New) A method for locating a mobile station, comprising:  
providing access to a plurality of mobile station location estimators for estimating locations of mobile stations, such that for each of at least some of the mobile stations, when one or more of said location estimators are supplied with corresponding data obtained from measurements of wireless signals transmitted between:

- (i) the mobile station, and
- (ii) at least one of: (1) a network of communication stations cooperatively linked for use in locating the mobile stations, and (2) one or more non-terrestrial wireless signal transmitting stations,

then said one or more location estimators each output corresponding location estimates of a geographical location of the mobile station;

receiving a request for locating a particular one of the mobile stations;

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first obtaining, from a first of said mobile station location estimators, a first location estimate of the particular mobile station when said corresponding data for said first estimator is input to said first estimator, said first estimator being dependent upon a result from a first component included in one of the component categories (a) through (e) following the step of second obtaining;

second obtaining from a second of said mobile station location estimators, a second location estimate of the particular mobile station when said corresponding data for said second estimator is input to said second estimator, said second estimator being dependent upon a result from a second component included in a component category (a) through (e) following different from said component category having said first component:

- (a) a category of pattern recognition components, wherein each said pattern recognition component estimates a location of one of the mobile stations from a pattern of a plurality of time delayed signal strengths of the wireless signal measurements provided by said corresponding data for said pattern recognition component;
- (b) a category of trainable mobile station location estimating components for estimating a location of the mobile station, wherein each said trainable

mobile station location estimating component is capable of being trained to associate: (i) each location of a plurality of geographical locations with (ii) corresponding measurements of wireless signals transmitted between some one of said mobile stations and the network of communication stations, wherein said some mobile station is approximately at the location;

(c) a category of triangulation components for estimating a location of the mobile station, wherein said triangulation components utilize measurements of wireless signals from their said corresponding data between the mobile station and three of the communication stations for determining a location estimate of the mobile station, wherein said measurements are a function of a signal time delay between the particular mobile station and at least one of the three communication stations, said at least one of the three communication stations being attached to the ground;

(d) a category of angle of arrival components for estimating a location of said particular mobile station, wherein each of said angle of arrival components determine a location estimate of the mobile station using a direction from which wireless signals arrive at at least one of the communication stations from the mobile station;

(e) a category of signal processing components for estimating a location of the mobile station using wireless signals received at the mobile station from the non-terrestrial transmitting stations, wherein said wireless signals provide time values, and said signal processing components determine at least one differential between the time values for the wireless signals transmitted by two of the non-terrestrial transmitting stations;

generating a resulting location estimate of the particular mobile station, said resulting location estimate being dependent upon an estimate of the particular mobile station from at least one of said first and second mobile station location estimators when said corresponding data for said at least one of the first and second estimators is input to said at least one of the first and second estimators;

wherein said step of generating includes at least one of the substeps (i) and (ii) following: (i) identifying at least one preferred location estimate from said first and second location estimates, said resulting location estimate being at least as dependent on said preferred location estimate as any other of said corresponding location estimates obtained, and (ii) combining said first and second location estimates for obtaining said resulting location estimate.

175. (New) The method of Claim 174, wherein said step of receiving includes receiving a communication related to one of: a location of a vehicle via the Internet, and a location of a 911 caller.

176. (New) The method of Claim 174, further including a step of requesting activation of at least one of said first and second mobile station location estimators via a communication on one of: the Internet and a telephony network.

177. (New) The method of Claim 174, further including a step of outputting information indicative of said resulting location estimate, wherein said information includes data providing a likelihood that the particular mobile station is located within a geographic area represented by said resulting location estimate.

178. (New) The method of Claim 174, further including a step outputting said resulting location to a predetermined destination on a communications network for one of: surveilling a parolee, locating an animal, locating a person related to a person initiating the request, providing a caller with his/her location, and. providing information indicative of whether the particular mobile station is a particular distance from an object whose location is known.

179. (New) A method for locating a wireless mobile station, comprising:  
repeatedly performing the following steps (A1) through (A3) for tracking the mobile  
station;

(A1) receiving a location estimate of the mobile station said location estimate  
obtained from using at least one of (a) and (b) following:

(a) first data obtained from wireless timing signals received by the  
mobile station from one or more satellites, wherein said timing signals from  
each of the one or more satellites identify a locus of locations of the mobile  
station; and

(b) second data obtained from time delays of wireless signals transmitted  
between the mobile station and one or more transceivers of a plurality of  
transceivers cooperatively linked together for use in locating the mobile  
station, wherein said time delays identify a locus of locations of the mobile  
from at least one of the transceivers;

wherein an instance of each of (a) and (b) are used at some time during the tracking  
of the mobile station for determining a respective location during the tracking of the mobile  
station;

(A2) determining a likely location of the mobile station by determining a likely  
roadway upon which the mobile station is located;

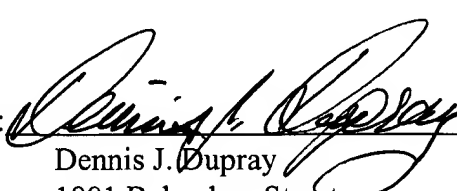
(A3) providing information indicative of said likely location information for  
displaying on a display device a representation of a location of the mobile station with a map  
having roadways thereon.

A check in the amount of \$216 is enclosed as payment of the fees for the additional  
of 11 independent claims and the additional 3 dependent claims.

Applicants respectfully submit that the claims are in condition for allowance and  
request the Examiner's favorable consideration and passage to issuance thereof.

Respectfully submitted,

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